

73. (NEW) A process according to Claim 70, wherein the catalyst further comprises nickel oxide, the balance being alumina.

74. (NEW) A process according to Claim 72, wherein the catalyst consists essentially of alumina and zinc oxide.

### REMARKS

Claims 32-74 are pending herein. By this Amendment, Claims 24-31 are cancelled; the specification is amended; and new Claims 32-74 are added. Support for the new claims is found in the specification at, *inter alia*, pages 35-39. Applicants respectfully note that co-pending U.S. Serial No. 09/190,853, filed on November 12, 1998, is directed to related, though patentably distinct, subject matter.

Applicants thank Examiner Nguyen for the courtesies extended them and their representative at the January 23, 2002 interview. Applicants' separate record of the interview is set forth in the foregoing amendments and following remarks.

#### I. REJECTIONS OVER ROSSIN

Claims 24-26, 28 and 31 were rejected under 35 U.S.C. 102(e) or, in the alternative, under 35 U.S.C. 103(a) over U.S. Patent No. 6,069,291 (Rossin). Claims 24-28 and 31 were rejected under 35 U.S.C. 103(a) over Rossin. Claims 24-31 are canceled. However, the rejections are respectfully addressed regarding new Claims 32-74.

Rossin discloses a catalytic process and composition for transforming perfluoro-alkanes (i.e., compounds containing only carbon and fluorine) in the presence of an oxidizing agent and water at temperatures between about 400 to 1,000°C. The catalyst contains aluminum oxide (col. 3, lines 55-58). Additions of between 0.1 to 50% by weight of other components such as barium, calcium, phosphorus, cerium, chromium, cobalt, iron, lanthanum, magnesium, nickel,

silicon, titanium, yttrium or zirconium may be added to the catalyst (col. 3, lines 66- col. 4, line 8).

Rossin does not disclose, teach or suggest, a catalyst comprising aluminum oxide and 7.2 to 49.4 wt.% nickel oxide, as claimed in Claim 32. Moreover, Rossin does not teach or suggest using such a catalyst to decompose (1) a compound containing carbon, hydrogen and fluorine; (2) a compound containing carbon, hydrogen, fluorine and oxygen; (3) SF<sub>6</sub>; and (4) NF<sub>3</sub>.

As discussed at the personal interview and as shown in the attached Declaration Under 37 C.F.R. 1.132 of Mr. Kanno, the claimed alumina-nickel oxide catalyst exhibits surprising and unexpected results by showing a high level of catalytic activity over an extended period of time. As shown in the 1.132 Declaration, CF<sub>4</sub> and a gas containing CHF<sub>3</sub>, CF<sub>4</sub> and C<sub>4</sub>F<sub>8</sub> were treated with a catalyst comprising aluminum oxide and a 26.8 wt.% nickel oxide. The catalyst surprisingly maintained a catalytic activity of greater than 99 % for over 2,000 hours. This represents at least a five-fold increase in catalyst life over the longest run of only 400 hours disclosed in Example XVII of Rossin. Further, an initial conversion rate of the alumina-nickel oxide catalyst is 99%. The conversion rate after 8,000 hours is at least 99% for a gas containing 5,000 ppm CF<sub>4</sub> at 700°C. This is a surprising and unexpected result. Moreover, according to the 1.132 Declaration, the claimed catalyst has been used in several semiconductor and liquid crystal display device manufacturing plants throughout the world since 2000 and to date has not needed to be replaced. The claimed process has also been recognized by several awards, including the U.S. Environmental Protection Agency's Climate Protection Award in 2002, and the Semiconductor International Editor's Choice Best Products Award of 2001.

Rossin also does not teach or suggest any catalyst comprising aluminum oxide and zinc oxide. Because the claimed processes exhibit surprising and unexpected results with respect to the catalyst life over an extended period of time, it would not have been obvious for one of ordinary skill in the art to practice the claimed process for treating a gas in view of the teachings of Rossin. Reconsideration and withdrawal of the rejections are respectfully requested.

## II. REJECTION OVER ROSSIN AND ROSENBAUM

Claims 29-30 were rejected under 35 U.S.C. 102(a) over Rossin in view of U.S. Patent No. 5,460,792 (Rosenbaum). Claims 24-31 are canceled. However, the rejection is addressed regarding new Claims 32-74.

As noted above, Rossin does not teach or suggest a catalyst comprising aluminum oxide and 7.2 to 49.4 wt. % nickel oxide.

Rosenbaum does not overcome the deficiencies of Rossin. Rosenbaum discloses a process for the removal and destruction of organic compounds in liquid and gaseous streams by complete oxidation of organic compounds in the presence of a carbonaceous catalyst at temperatures below 400°C (Abstract). The carbonaceous adsorbents may be based on pyrolyzed resinous polymers (col. 4, lines 65-67). Like Rossin, Rosenbaum does not teach or suggest the claimed alumina-nickel oxide catalyst or the surprising and unexpected results that are obtained with the claimed catalyst. Moreover, neither Rossin nor Rosenbaum teaches or suggests the claimed alumina-zinc oxide catalyst. Thus, it would not have been obvious for one of ordinary skill in the art to practice the claimed methods in view of the combined teachings of Rossin and Rosenbaum. Reconsideration and withdrawal of the rejection are respectfully requested.

## III. CONCLUSION

In light of the foregoing remarks, this application should be in condition for allowance and early passage of this case to issue is respectfully requested. If there are any questions regarding this Amendment or the application in general, a telephone call to the undersigned would be appreciated since this would expedite the prosecution of the application for all concerned.

If necessary to effect a timely response, this paper should be considered as a petition for an Extension of Time sufficient to effect a timely response, and please charge any deficiency in fees or credit any overpayments to Deposit Account No. 05-1323 (Docket #381AS/50311TR).

Respectfully submitted,

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**MARKED-UP VERSION SHOWING CHANGES MADE**

**IN THE SPECIFICATION:**

Page 1, before line 1, insert:

**--CROSS-REFERENCE OF RELATED APPLICATION**

The subject matter of this application is related to co-pending U.S. Serial No. 09/190,853, filed on November 12, 1998.--

Page 17, lines 8-21:

Reactor tube was an Inconel reactor tube having an inner diameter of 19 mm, where a catalyst bed was fixed at the center of the reactor tube and had an Inconel thermowell for a thermo couple, 3 mm in outer diameter, inside the catalyst bed. Decomposition product gas discharged from the catalyst bed was bubbled through an aqueous sodium [chloride] hydroxide solution and [an] then discharged as an exhaust gas.  $C_2F_6$  decomposition rate was calculated by the following equation by determining concentration of  $C_2F_6$  in the reaction gas at the inlet to the reactor tube and concentration of  $C_2F_6$  in the decomposition gas at the outlet from the alkaline washing step by FID (flame ionization detector) gas chromatography and TCD (thermal conductivity detector) gas chromatography:

Page 29, lines 20-27:

The reactor tube was an Inconel reactor tube having an inner diameter of 32 mm and had a catalyst bed fixed at the center of the reactor tube. An Inconel thermowell for a thermocouple, 3 mm in diameter, was inserted into the catalyst bed. Decomposition product gas from the catalyst bed was bubbled through an aqueous calcium [fluoride] hydroxide solution and discharged to the system outside.

Page 34, lines 21-27:

Test results of the foregoing catalysts 19 and 26 - 36 at a reaction temperature of 700°C are shown in Fig. 6, C<sub>2</sub>F<sub>6</sub> decomposition activity is highest with the Al<sub>2</sub>O<sub>3</sub>-ZnO<sub>2</sub> catalyst and is lowered in the order of the Al<sub>2</sub>O<sub>3</sub>-NiO catalyst, and the Al<sub>2</sub>O<sub>3</sub>-TiO<sub>2</sub> catalyst. The highest activity of catalyst [26] 27 seems to be due to the effect of S.

Page 40, lines 2-12:

#### Example 10

In this Example, influences of steam upon C<sub>2</sub>F<sub>6</sub> decomposition were investigated under the same test conditions as in Example 6 except that the space velocity was changed to 1,000 h<sup>-1</sup>. Al<sub>2</sub>O<sub>3</sub>-NiO catalyst 28-3 was used at a reaction temperature of 700°C while supplying steam for 2 hours from the start of test, then interrupting supply of steam for 3 hours, and then starting to supply steam again. Test results are shown in Fig. 10. It was found that during the supply of steam the C<sub>2</sub>F<sub>6</sub> reaction rate was elevated due to the occurrence of C<sub>2</sub>F<sub>6</sub> hydrolysis.

Page 40, lines 13-26:

#### Example 11

In this Example, decomposition of SF<sub>6</sub> was investigated with Al<sub>2</sub>O<sub>3</sub>-NiO catalyst 28-3 under the same test conditions as in Example 6 except that a SF<sub>6</sub> gas having a purity of 99% or more was used, the space velocity was changed to 1,000 h<sup>-1</sup> and the SF<sub>6</sub> gas was diluted with nitrogen [in] instead of air. The reaction temperature was 700°C. Concentration of SF<sub>6</sub> in the reaction gas at the inlet to the reactor tube and concentration of SF<sub>6</sub> in the decomposition gas at the outlet from the alkaline washing step were determined by TCD gas chromatography and the decomposition rate was calculated by the following equation. It was found that the decomposition rate was 99% or more.